Debian + YoctoProject Based Projects: Collaboration Status

Kazuhiro Hayashi, Toshiba Corporation
Japan Technical Jamboree 63
Dec 1, 2017

Background

- **3 Debian-based projects for embedded products**
  - ELBE: https://elbe-rfs.org/ [1]
  - Isar: https://github.com/ilbers/isar [2]
  - Deby: https://github.com/meta-debian/meta-debian
  - Developed individually
- **Introduced in ELCE 2016 @ Berlin**
  - The three projects have
    - Common features
    - Different approaches
      - e.g. native-build v.s. cross-build
- **Started collaboration**
  - Made presentation in OSSJ2017 [3]
- **Met again in ELCE 2017 @ Prague**
  - Status updates of ELBE [4]
  - Collaborative discussion

http://events.linuxfoundation.org/events/archive/2016/embedded-linux-conference-europe/program/schedule

Motivation

- **Common requirements**
  - Stability
  - long-term maintenance
  - Reproducibility
  - Customization for embedded systems
  - License clearing
- **Based on the same resources**
  - Debian packages
  - Debian tools (e.g. debootstrap)
  - Bitbake, OE-Core
- **Seek working with community**
- **Benefits of collaboration**
  - Avoid effort duplication
  - Achieve more

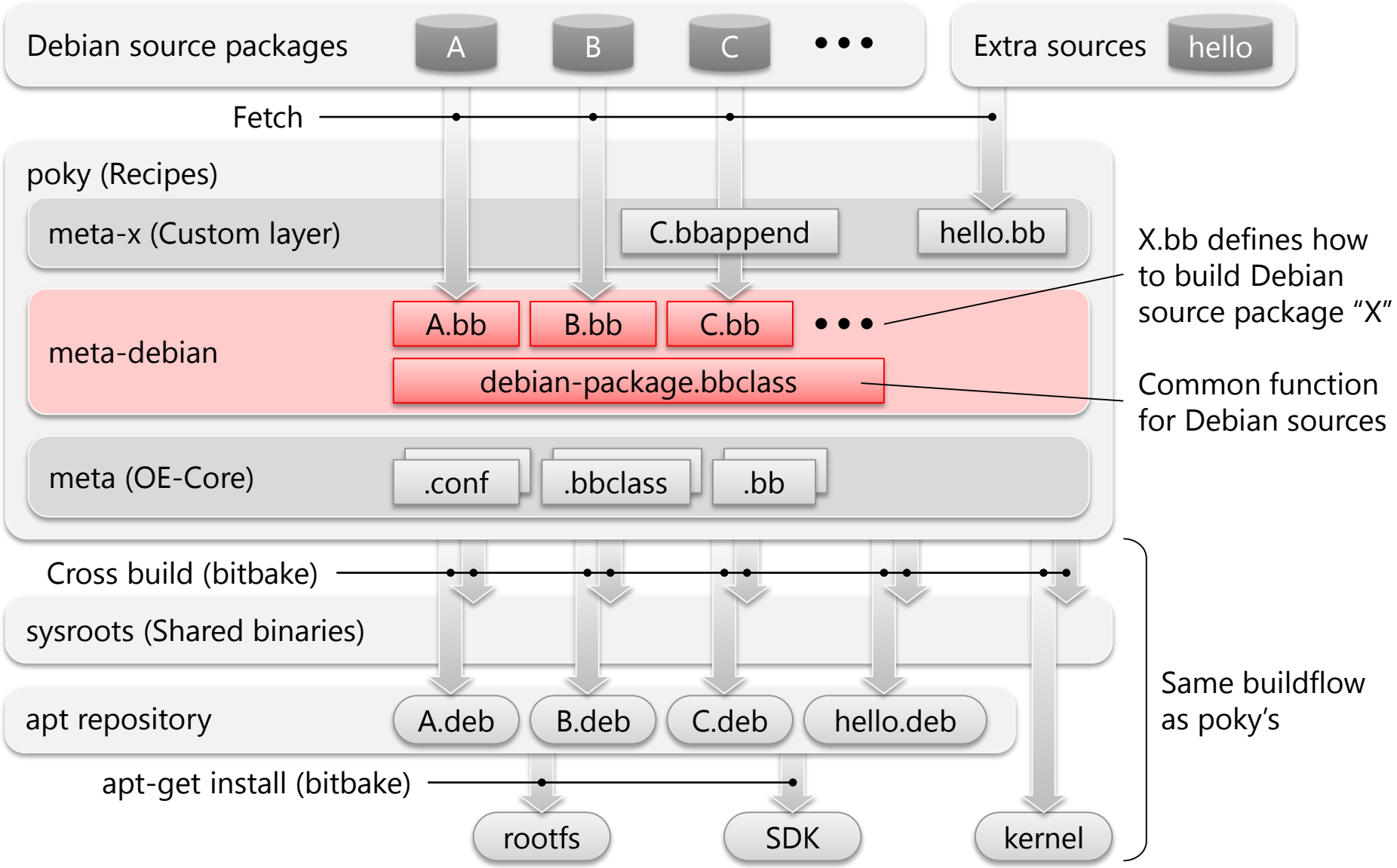
Deby

- **A reference Linux distribution for embedded system**
- **“Shared Embedded Linux Distribution” project**
  - One of the activities of CELP (Core Embedded Linux Project)
    - https://www.linuxfoundation.jp/projects/core-embedded-linux
  - Goals
    - Create an industry-supported embedded Linux distribution
    - Provide supports for long term
- **Based on the two projects**
  - Debian GNU/Linux
    - Cross-built from Debian source packages
  - Yocto Project
    - Cross-built with **Poky** build system and metadata for Debian source packages (**meta-debian**)
- **Origin of the name**
  - **Deb**ian + Pok**y**
  - **Deb**ian**-like**

Deby: Purposes

- **Providing features required in embedded systems, including civil infrastructure**
  - Stability
    - Well-tested software set
  - Long-term support
    - 10+ years, especially for security fixes
  - Customizability
    - Changing configure options, compiler optimizations, etc.
  - Wider hardware support
- **Contribution and collaboration with other communities**
  - Debian, Debian-LTS
  - Yocto Project
  - Similar Debian-based projects like ELBE and Isar

Deby: How it works



Deby: How to use

- **Repository**
  - https://github.com/meta-debian/meta-debian
- **Quick start**
  - https://github.com/meta-debian/meta-debian/blob/morty/README.md
- **Example: Build the minimal images and run on QEMU**

```
$ git clone -b morty git://git.yoctoproject.org/poky.git
$ cd poky
$ git clone -b morty https://github.com/meta-debian/meta-debian.git
$ cd ..
$ export TEMPLATECONF=meta-debian/conf
$ source ./poky/oe-init-build-env
$ bitbake core-image-minimal
$ runqemu qemux86 nographic
```

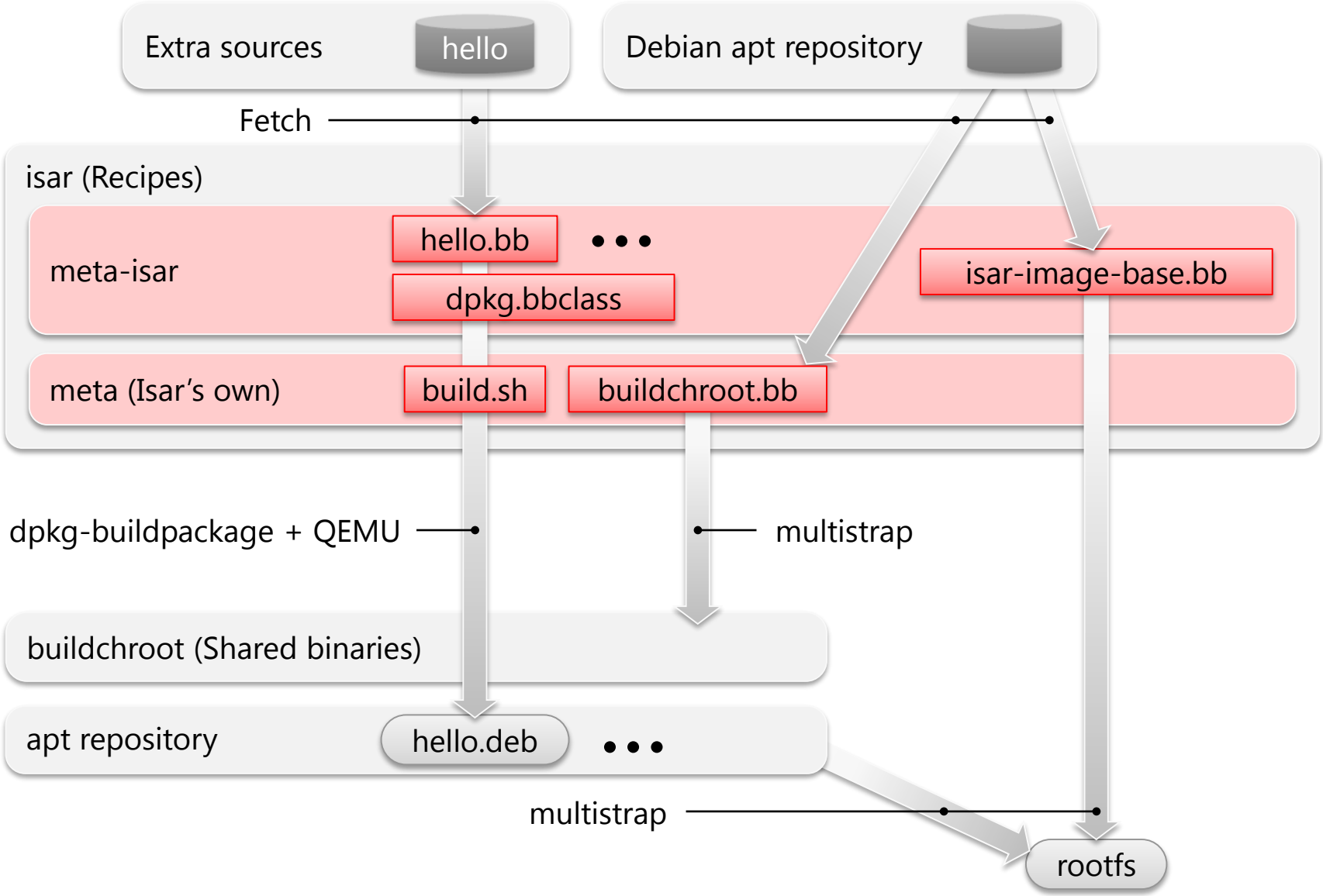
Isar

- **Image generation for embedded systems**
  - Installs Debian binary packages as a base system
  - Builds and installs product's software packages
  - Creates ready-to-use firmware images
  - Just a build system, **not a distribution**
- **Origin**
  - Predecessor system at Siemens
  - Developed by ilbers GmbH
  - Sponsored by Siemens
- **Uses:**
  - BitBake: Recipes for building and installing packages
  - Yocto: Structure, layering, workflow (**doesn't rely on poky** code base)
  - Debian: Binary packages (**not included in Isar**)
- **Name**
  - **I**ntegration **S**ystem for **A**utomated **R**oot filesystem generation
  - A river in Munich

Isar: Goals

- **Product build system**
  - **One-command, on-demand** building
  - Reproducibly create ready-to-use firmware images
  - Integrate product applications and customizations
  - Multiple upstreams, **multiple products**, strong reuse
  - Easy for beginners, **familiar and powerful** for advanced
- **Customer requirements**
  - Low effort: Native builds, **no massive changes** to upstream packages
  - Scale from small to big
  - Security updates
  - Maintenance: 10+ years
  - Legal clearing

Isar: How it works



Isar: How to use

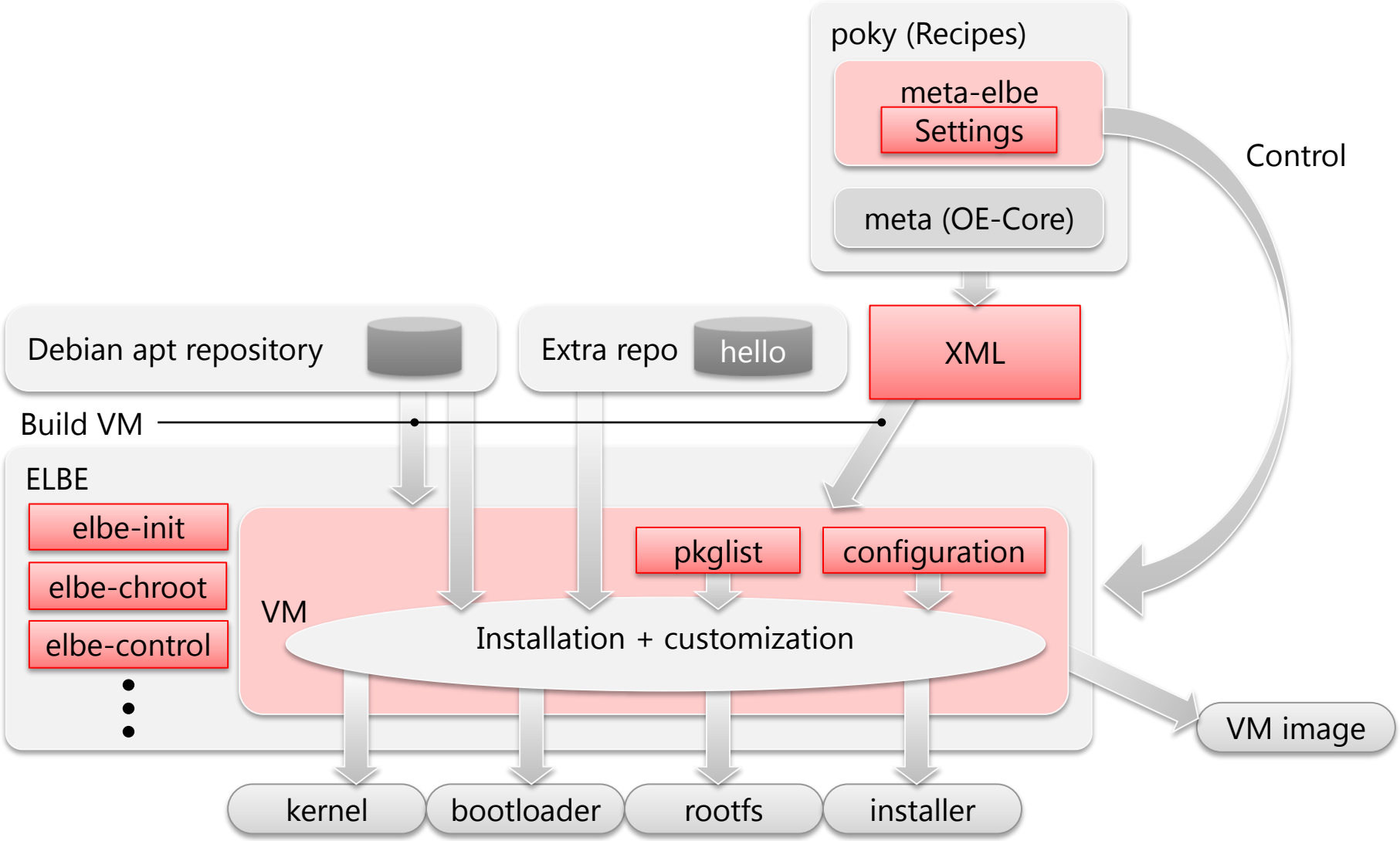
- **Repository**
  - https://github.com/ilbers/isar
- **Quick start**
  - https://github.com/ilbers/isar/blob/master/doc/user_manual.md
- **Example: Build a minimal image and run under QEMU**

```
$ su -c "apt-get install dosfstools git mtools multistrap parted
python3 qemu qemu-user-static sudo"
$ su -c "echo -e $USER¥¥¥¥tALL=NOPASSWD:¥ ALL >>/etc/sudoers"
$ git clone https://github.com/ilbers/isar
$ cd isar
$ . isar-init-build-env ../build
$ bitbake isar-image-base
$ start_armhf_vm  # User: root, password: root
```

ELBE

- **Image generation tool for embedded systems**
  - Create bootloader, kernel, and rootfs images for specific architecture
  - Build natively on “build VM” (chroot, QEMU)
  - Use pre-build Debian binary packages directly
  - Customize everything by defining one XML file
- **OE-Core adaptation available**
  - https://github.com/Linutronix/nneta-elbe
  - Work as front-end of ELBE
    - Control ELBE core functions
    - Automatically generate ELBE XML from bitbake variables
- **Name**
  - ELBE: The Embedded Linux Build Environment

ELBE: How it works



ELBE: How it works

```
<ns0:RootFileSystem xmlns:ns0="https://www.linutronix.de/projects/Elbe"
        xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
        created="2009-05-20T08:50:56" revision="6"
        xsi:schemaLocation="https://www.linutronix.de/projects/Elbe dbsfed.xsd">
        <project>
                <name>ARMexample</name>
                <version>08.15</version>
                <description>full featured debian system</description>
                <buildtype>armel</buildtype>
                <mirror>
                        <primary_host>debian.tu-bs.de</primary_host>
                        <primary_path>/debian</primary_path>
                        <primary_proto>http</primary_proto>
                        <url-list>
                                <url>
                                        <binary>http://d
                                </url>
                        </url-list>
                </mirror>
                <noauth />
                <suite>wheezy</suite>
                <buildimage>
                        <kinitrd>elbe-bootstrap</kinitrd
                </buildimage>
        </project>
        <target>
                <hostname>myARM</hostname>
                <domain>tec.linutronix.de</domain>
                <passwd>foo</passwd>
                <console>ttyS0,115200</console>
                <package>
                        <tar>
                                <name>nfsroot.tar.gz</name>
                        </tar>
                </package>
                <finetuning>
                </finetuning>
                <pkg-list>
                        <pkg>bash</pkg>
                        <pkg>openssh-server</pkg>
                </pkg-list>
        </target>
</ns0:RootFileSystem>
```

ELBE: How to use

- **Repository**
  - https://github.com/Linutronix/nneta-elbe
- **Quick start**
  - https://github.com/Linutronix/nneta-elbe/blob/master/README
- **Example: Build an image**

```
$ git clone http://git.yoctoproject.org/git/poky
$ cd poky
$ git reset --hard 924e576b8930fd2268d85f0b151e5f68a3c2afce
$ git clone https://github.com/Linutronix/nneta-elbe
$ git clone https://github.com/Linutronix/nneta-elbe-ext
$ TEMPLATECONF=nneta-elbe/conf . ./oe-init-build-env build-elbe
$ elbe initvm create
$ elbe initvm start
$ bitbake simple-image
```

Comparison

	ELBE	Isar	Deby
Yocto-style development	Y	Y	Y
Kernel / Bootloader	Y	Y	Y
Use Debian source package	Y	Y	Y
Default footprint	300MB	300MB	10MB
Non-Debian archs support	N	N	Y
Export used source code	N	N	Y (download dir)
Yocto-style SDK	N (possible)	N	Y
Generate license info	N (possible)	N	Y (csv)
Reproducibility	VM, pbuilder	Shared chroot	Use git tags
Use Debian binary package	Y	Y	N
# of Available packages	All	All	Limited (600 .dsc)
Effort for adapting (update)	Low	Low	High
Signed apt repository	Y	deb:N dsc:Y	N

Comparison

	ELBE	Isar	Deby
Yocto-style development	Y	Y	Y
Kernel / Bootloader	Y	Y	Y
Use Debian source package	Y	Y	Y
Default footprint	300MB	300MB	10MB
Non-Debian archs support	N	N	Y
Export used source code	N	N	Y (download dir)
Yocto-style SDK	N (possible)	N	Y
Generate license info	N (possible)	N	Y (csv)
Reproducibility	VM, pbuilder	Shared chroot	Use git tags
Use Debian binary package	Y	Y	N
# of Available packages	All	All	Limited (600 .dsc)
Effort for adapting (update)	Low	Low	High
Signed apt repository	Y	deb:N dsc:Y	N

Ideas for collaboration

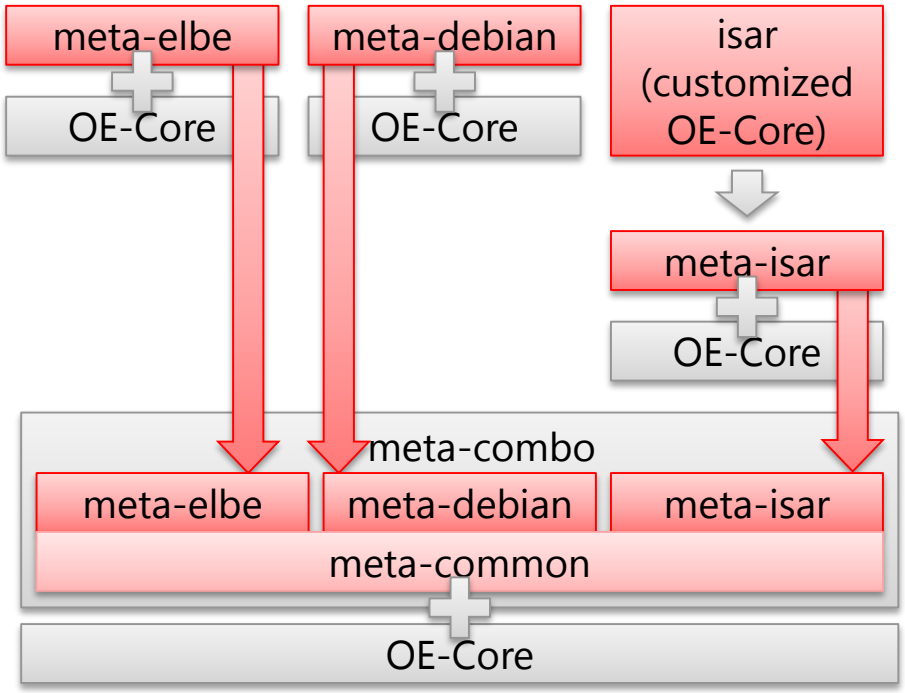
- **Topics**
  - Place to develop together
  - Policy to share our existing resources
  - What we need to change
  - Clarify requirements: Common / different goals
  - Debian way v.s. YoctoProject (OE-Core) way
  - Native build v.s. Cross build
  - License clearing and software component catalogue generation
- **Workflow**
  - Share the current benefits and issues of the both projects
  - Find features that could be shared
  - Create a proof of concept of the common features
  - List up issues, then define the next iteration

Collaboration status (1)

- **Created a common repository**
  - https://github.com/manut/meta-combo
  - Project layers included
    - meta-elbe (for ELBE)
    - meta-debian (for Deby)
    - meta-isar (for Isar) => Under discussion
  - Imported from original repositories with combo-layer
    - https://wiki.yoctoproject.org/wiki/Combo-layer

Collaboration status (2)

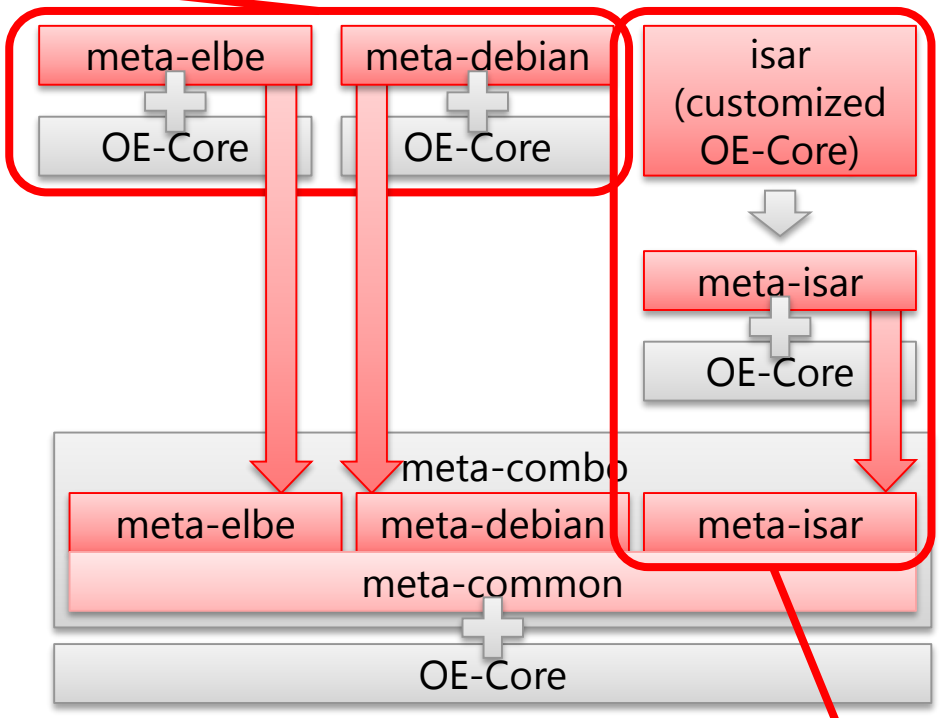
- **Shared ideas about how to develop the common layer**



Collaboration status (2)

- **Shared ideas about how to develop the common layer**

Plan: Find out the features which could be shared and put them into meta-common

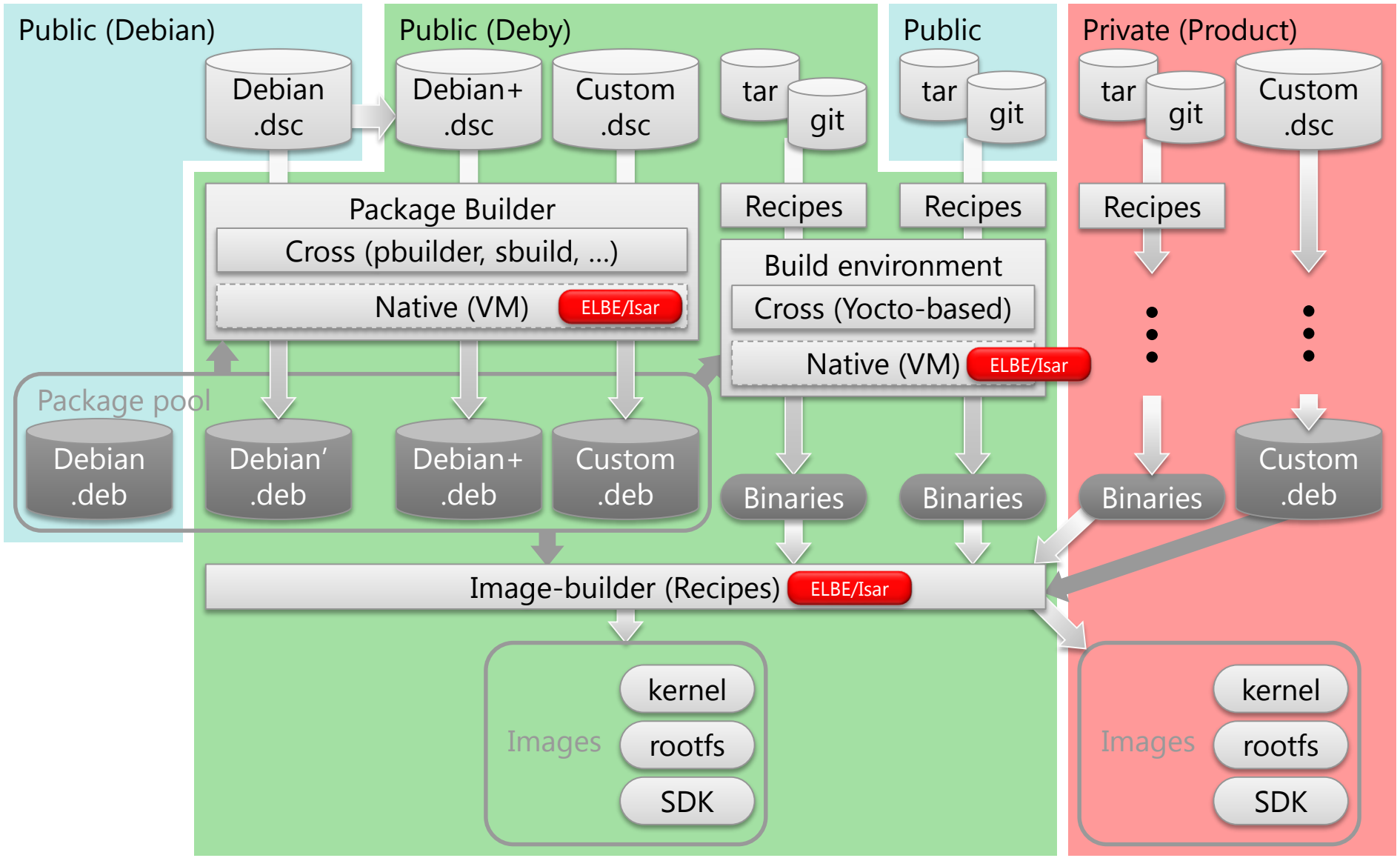


Plan: Under discussion
Idea: 1. Move Isar specific features to meta-isar
2. Put the common features in meta-isar into meta-common

Collaboration status (3)

- **Clarify required features in our build systems**
  - **Debian binary package pool**
    - Need to reuse binary packages to reduce the build time
    - Deby wants to avoid full-building
  - **Native package builder**
    - ELBE and Isar usually need native build which is officially supported in Debian (more stable than cross-building)
  - **Cross package builder**
    - Deby needs cross-building and is already doing now
    - ELBE and Isar sometimes want cross-building to build quickly big packages or kernels
  - **Build environment for extra sources (Cross/Native)**
    - Kernel, bootloader, application, etc.
  - **Image builder**
    - Generate rootfs and SDK from pre-built binaries in above builders
    - Provides customization and adaptation for embedded boards
  - **YoctoProject-based layer structure in metadata**
    - All recipes should be included in proper project (product) layer

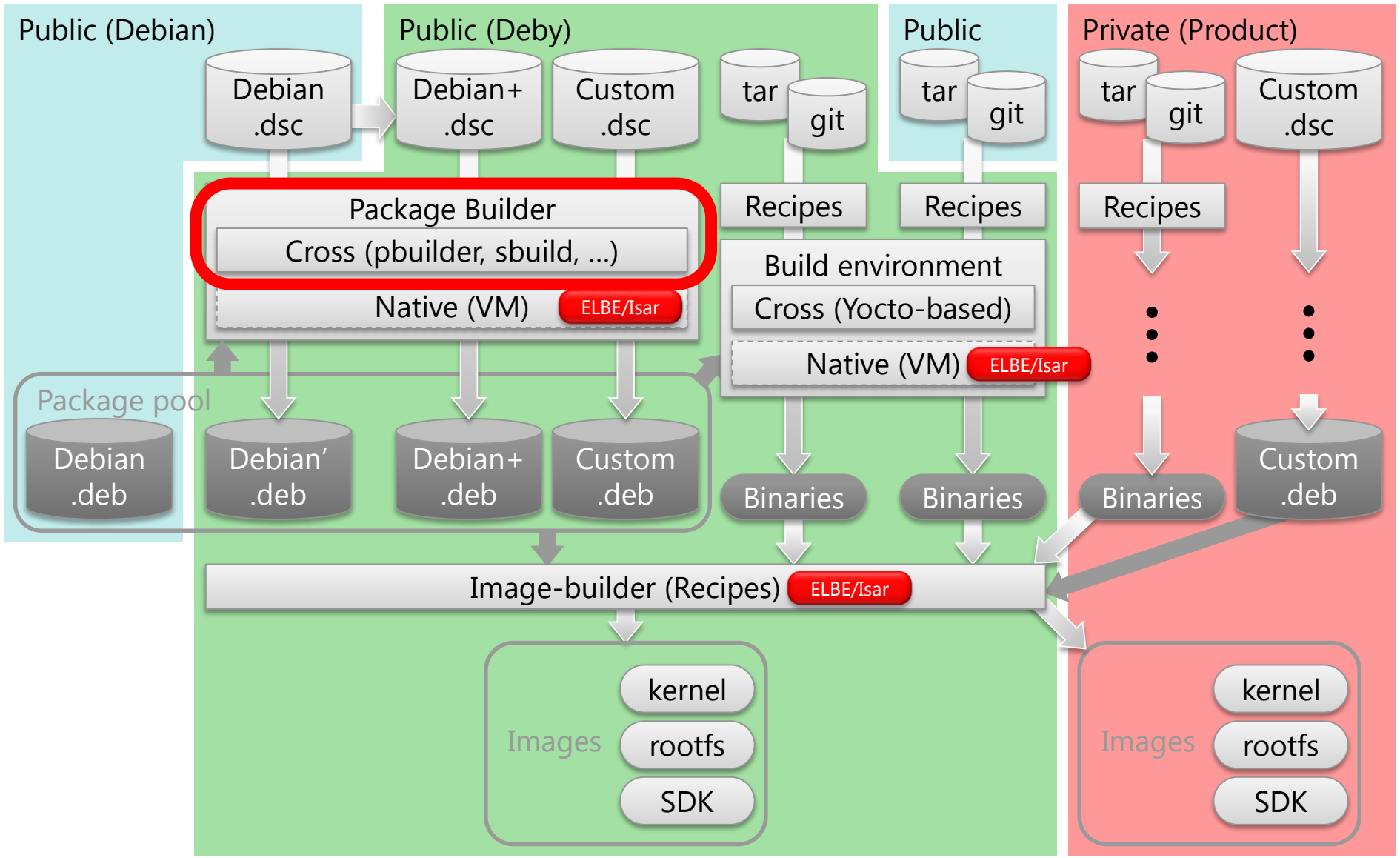
Collaboration status (3)



Collaboration status (4)

- **Deby: Provides new experimental metadata set**
  - Purpose: Add new features required to satisfy our requirements with existing resources in ELBE/Isar
    - Currently designed for OE-Core infrastructure
  - Name: meta-debian-next
    - https://github.com/meta-debian/meta-debian/tree/next-poc/meta-debian-next
  - Very small, but the first step
  - Features
    - Provides a class file for cross-building Debian source packages with pbuilder through bitbake
    - Depends on meta-elbe
      - Reuse existing bitbake configuration in meta-elbe

Collaboration status (4)



Future plan

- **Deby (meta-debian-next)**
  - Implement remaining features (PoC)
    - Build environment for extra sources
      - Debian binary packages + Current Deby way (Yocto-based)
    - Image builder
      - Try to reuse existing functions in Isar / ELBE
- **meta-combo**
  - Create example that uses multiple layers
    - e.g. meta-debian + meta-elbe
  - Isar integration
- **Clarify our requirements (more)**
  - Concrete requirements in our products
  - What is needed in the market
  - Available resources for collaboration are not unlimited
    - Sharable benefits required to change our current ways

References

1. Using ELBE To Build Debian Based Embedded Systems – Embedded Linux Conference Europe 2016 https://elinux.org/images/e/e5/Using_ELBE_to_Build_Debian_Based_Embedded_Systems.pdf
2. Isar Build Debian-Based Products with BitBake - FOSDEM 2017 https://archive.fosdem.org/2017/schedule/event/debian_based_with_bitbake/attachments/slides/1817/export/events/attachments/debian_based_with_bitbake/slides/1817/isar_fosdem_2017.pdf
3. Building Debian-Based Products: Experiences in Collaboration – Open Source Summit Japan 2017 http://events.linuxfoundation.org/sites/events/files/slides/ISAR-DEBY-OSSJ2017_r10.pdf
4. How to combine Debian and Yocto/Bitbake? – Embedded Linux Conference Europe 2017 http://events.linuxfoundation.jp/sites/events/files/slides/Yocto%20%2B%20Debian%20.pdf